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Testing the Supply-leading and Demand-following Hypothesis for Financial Development and Economic Growth – A Case of the Nigerian Banking System

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Abstract

The study examined financial development and economic growth in the context of the Nigerian banking system using the Toda-Yamamoto approach to Granger causality to test whether the relationship between financial development and economic growth follows the pattern of supply-leading and demand-following hypothesis propounded by Patrick (1966). The financial development indicators of the banking system, which depicts financial deepening and stability for the period 1960 to 2019 were utilised. The findings of the study showed that the relationship between financial development and economic growth was neither supply-leading nor demand-following for the sub-periods of 1960-1985 and 1986-2019. However, for the entire period of 1960-2019, the demand-following hypothesis was established, suggesting that in Nigeria economic growth granger cause financial development. This implied that financial development stemming from the banking system does not drive economic growth in Nigeria. In view of this, it was recommended that efforts be made by government to diversify and fast-track development in the economy to ensure that financial development impacts on economy.

Keywords: Banking system, Financial development, Economic growth, Causality, Supply-leading, Demand-following

1. Introduction

Extensive research has been carried out across jurisdictions to ascertain the causal relationship between financial development and economic growth. Although studies undertaken have not reached a consensus on the nature of relationship between financial development and economic growth, it is expected that there will never be as different financial system exhibit divergent development patterns either stemming mainly from the banking system and/or capital market. Some studies posit that financial development leads economic growth (supply-leading hypothesis), while others opine that it is economic growth that leads financial development (demand-following hypothesis). Another view put forward is that the relationship is bi-directional and a few others were neutral, that is, no relationship.

Studies by Craigwell et al., (2001), World Bank (2005) and Soukhakian (2007) have supported the supply-leading hypothesis. Conversely, studies Waqabaca (2004), Ang and McKibbin (2005) and Guryay

et al., (2007) and Chukwu & Agu (2009) have lent credence to the demand-leading hypothesis. Some other studies by Patrick (1966) and Calderon & Liu (2002) established that there is a two-way causal relationship between financial development and economic growth, that is, financial development cause economic growth and vice versa. In Patrick's view, this depends on the stage of development of an economy with supply-leading occurring at the early stages of economic development of a country and demand-following at the later stages of development.

The objective of this article is to test the Patrick's supply-leading or demand-following hypothesis to ascertain whether the relationship between financial development of the Nigerian banking system and economic growth follows the pattern propounded. The study applies the Toda-Yamamoto approach to Granger causality, which is tested across the relevant sample periods that capture the evolving pattern of the Nigerian economy. Studies carried out in Nigeria have examined the direction of causality to determine whether it is supply-leading or demand-following but none has examined the proposition that supply-leading hypothesis takes place at the early stages of development and changes as the economy progresses with demand-following hypothesis in the later stages. This study is in this regard.

Following the introduction, the rest of the paper is divided into Section 2, which provides the theoretical framework of the study. Section 3 reviews empirical studies on the subject. Section 4 outlines the methodology, Section 5 presents the results and discussion and Section 6 concludes the paper.

2. Theoretical Framework

The theoretical framework for this study adopts the endogenous growth model, which is one of the theoretical models utilised in analysing the financial development-economic growth nexus. This is premised on the fact that financial intermediation promotes growth in an economy. The Endogenous growth theory or new growth theory is premised on growth being determined by internal factors and not as a result of exogenous factors. The Endogenous growth model assumes increasing returns to scale and is useful in analysing long run growth rate differentials across countries.

Several studies have utilised the endogenous growth model to explain the relationship between financial development and economic growth. Greenwood and Jovanovic (1990) posited that there is a link between economic growth and financial development. Economic growth during early stages of development is slow given that the financial structure is not well-developed. As economic growth progresses, income rises and the financial structure gradually develops. At latter stages of maturity when economic growth is sustained and remains high, income stabilizes and the financial structure fully develops. Bencivenga and Smith (1991) established that financial intermediation enhances economic growth through savings and investments. Financial intermediaries play a role in the allocation of resources by channelling savings to productive investments in an economy. Pagano (1993) used the Endogenous growth model to demonstrate that financial intermediation and other factors are essential for economic growth. The model shows the relationship between financial development and economic growth, which is achieved through the increase in savings for investment purposes, change in marginal productivity of capital and savings rate. The model is simply expressed as:

$$Y = AK_t \qquad (1)$$

Where Y is the aggregate output

A represents the marginal productivity of capital

K_t is the aggregate capital stock

3. Empirical Review

Empirical studies involving cross-country and individual country analyses have been carried out to examine the relationship between financial development and economic growth. Some of the studies are discussed with emphasis on the causality results obtained. Okwo et al. (2012) analysed the relationship between financial development and economic growth using the ratio of M2 to GDP, ratio of credit to the

private sector to GDP, government consumption and trade openness. The Granger causality test indicated no causality.

Ogwumike and Salisu (2012) used the VAR-Granger causality test to determine the existence of the demand following or supply-leading hypothesis in Nigeria with data covering the period 1975 to 2008. Stock market capitalization, credit to the private sector, real discount rate, bank deposit liability and investment were used in the study. The results showed that financial development lead economic growth, evidencing supply-leading hypothesis.

Osuji and Chigbu (2012) employed Error Correction Model and Granger causality test to ascertain the direction of causality between financial development and economic growth. The variables money supply, credit to private sector and gross domestic product (GDP) were used covering the period 1960 to 2008. The findings of the study showed the existence of a bi-directional causality between financial development and economic growth.

Osuji (2015) evaluated the causal relationship between financial development and economic growth from 1960 to 2014. He employed Vector Error Correction Model (VECM) and Granger causality test within multivariate cointegration. The result was mixed as private sector credit and bank deposit liabilities as indicators of financial development granger caused economic growth while with money to income ratio and domestic credit ratios, economic growth granger caused financial development.

Modebe and Ezeaku (2016) employed Johansen cointegration and Granger causality test. The data covered 1987 to 2014 with banking and stock market indicators as well as trade openness, foreign direct investment and inflation rate utilised. The Granger causality results showed that stock market granger caused GDP, GDP caused foreign direct investment and no causality for other variables.

Karimo and Ogbonna (2017) examined whether the relationship between financial development and economic growth in Nigeria followed the supply-leading hypothesis using the Toda and Yamamoto technique. Financial development indicators of the banking sector and capital market covering the period 1970 to 2013 were utilised. The result evidenced a supply-leading hypothesis for Nigeria.

Hasan (2018) evaluated the same relationship for Indonesia using Johansen co-integration and Granger causality. Variables for financial development, inflation, government expenditure, GDP and trade openness from 1986 to 2014 were used. The result supported the demand-following hypothesis.

Kamalu et al., (2019) assessed the direction of causality between financial development, financial inclusion and economic growth in Nigeria using the Gregory and Hansen cointegration and Toda and Yamamoto tests. The study period was from 1970 to 2018 and utilised the variables of financial development for depth, access and efficiency, foreign direct investment; and economic growth. The findings showed that there exists a bidirectional causality between financial development and economic growth while a unidirectional causality was found between financial inclusion and economic growth.

Odo et al., (2020) analysed the relationship between financial development and economic growth in Nigeria and South Africa from 1980 to 2014. They applied the VECM and Granger causality and used the ratios of broad money supply and domestic credit to private sector to GDP, real interest rate and economic growth. The study established a unidirectional causality for Nigeria and a bidirectional causality for South Africa.

4. Methodology

The study examines the Patrick's hypothesis that the relationship between financial development and economic growth could either be supply-leading or demand-following with the former taking place at early stages of economic development and the latter occurring at later stages.

Data and Description of Variables

The research design for the study is ex-post facto and annual data obtained from the Central Bank of Nigeria Statistical Bulletin is used. The study period is from 1960 to 2019, which is limited due to the non-availability of data. The hypothesis is examined using the entire period and sub-periods of 1960-1985, which heralded the discovery of oil in Nigeria as well as 1986-2019 when some reforms commenced with the Structural Adjustment Programme and various reforms in the financial system.

The financial development indicators of the banking sector that indicate financial deepening and stability are utilised viz: the ratio of money supply to GDP (MS) and ratio of private sector credit to GDP (CP) for financial deepening and liquidity ratio (LR) for stability while real GDP growth rate (RG) is used for economic growth.

Model Specification

The study employs the Toda–Yamamoto approach to Granger causality test. This was first used by Toda-Yamamoto (1995) to overcome the drawbacks of the Granger causality test. It is based on the estimation of an augmented Vector Autoregressive (VAR) model of $k + d_{max}$ (k is the optimal lag length and d_{max} is the maximum order of integration), that is based on levels of the variables and not the first differences, to generate asymptomatic VAR statistics (Modified Wald-statistics) in the form of chi-squared distribution. It takes into consideration causality testing of arbitrary orders as against the general VAR, which results in the loss of information in the long run. The merit of this approach is its applicability irrespective of the order of integration I(0), I(1) or I(2) of variables, thus eliminating the bias associated with unit root and cointegration tests. The need to pre-test for cointegration is not necessary because it does not affect the analysis, especially if the variables are not I(1).

The Toda-Yamamoto model of VAR (k + dmax) is specified as follows:

$$RG_t = \alpha_o + \sum_{j=1}^{k+dmax} \alpha_{1j} RG_{t-j} + \sum_{j=1}^{k+dmax} \alpha_{2j} MS_{t-j} + \sum_{j=1}^{k+dmax} \alpha_{3j} CP_{t-j} + \sum_{j=1}^{k+dmax} \alpha_{4j} LR_{t-j} + \cup_{1t} \quad (2)$$

$$MS_t = \beta_o + \sum_{j=1}^{k+dmax} \beta_{1j} RG_{t-j} + \sum_{j=1}^{k+dmax} \beta_{2j} MS_{t-j} + \sum_{j=1}^{k+dmax} \beta_{3j} CP_{t-j} + \sum_{j=1}^{k+dmax} \beta_{4j} LR_{t-j} + \cup_{2t} \quad (3)$$

$$CP_t = \lambda_o + \sum_{j=1}^{k+dmax} \lambda_{1j} RG_{t-j} + \sum_{j=1}^{k+dmax} \lambda_{2j} MS_{t-j} + \sum_{j=1}^{k+dmax} \lambda_{3j} CP_{t-j} + \sum_{j=1}^{k+dmax} \lambda_{4j} LR_{t-j} + \cup_{3t} \quad (4)$$

$$LR_t = \pi_o + \sum_{j=1}^{k+dmax} \pi_{1j} RG_{t-j} + \sum_{j=1}^{k+dmax} \pi_{2j} MS_{t-j} + \sum_{j=1}^{k+dmax} \pi_{3j} CP_{t-j} + \sum_{j=1}^{k+dmax} \pi_{4j} LR_{t-j} + \cup_{4t} \quad (5)$$

Where Y_{1t} = vector of endogenous variables; α_0, β_0, λ_0, and π_0 = vector of constant terms; α_j, β_j, λ_j, π_j = coefficients of autoregressive terms; k + dmax = lag length plus maximum order of integration
t-j = lagged values of the variables; u_t = stochastic error terms.

In estimating the model, the first step is to test for unit root using the Augmented Dickey Fuller (ADF) and Kwiatkowski-Phillips-Schmidt-Shin (KPSS tests) to determine the additional lags to be added to the Toda-Yamamoto VAR(k+dmax). The analysis is carried out using e-views 10.

5. Results and Discussion

The results of the unit root test, lag order selection criteria and Toda-Yamamoto test are discussed in this section.

Unit Root Test

The results of the unit root tests performed using the ADF and KPSS are presented in table 1 and 2, respectively. The ADF statistics shows that only RG is stationary at level while the rest are stationary at first difference. For the KPSS statistics, RG, MS and LR are stationary at levels and CP is stationary at first difference. The essence of the unit root test is to determine the maximum order of integration (dmax) for the augmented VAR.

Table 1: ADF Unit Root Result

Variables	ADF at level	ADF at first difference	Critical value**	Order I(d)
RG	-5.638847*	-8.195465*	-2.912631	I(0)
MS	-2.487907	-9.205964*	-2.912631	I(1)
CP	-1.509720	-7.679128*	-2.912631	I(1)
LR	-2-125075	-5.646679*	-2.914517	I(1)

* significant at 1%, 5% and 10%
**5% critical values presented for level and first difference

Table 2: KPSS Unit Root Result

Variables	KPSS at level	KPSS at first difference	Critical value**	Order I(d)
RG	0.198683*	0.500000	0.463000	I(0)
MS	0.217721*	0.090021*	0.463000	I(0)
CP	0.562380	0.093008*	0.463000	I(1)
LR	0.123181*	0.121793*	0.463000	I(0)

* significant at 5%; **5% critical values

Lag Order Selection Criteria

The lag order selection criteria test was employed to determine the lag length (k). A lag length of 1 was used for the sub-periods of 1960-1985 and 1986-2019, as specified by all the information criteria viz: the Akaike, Schwarz, Hannan-Quinn and final prediction error information criteria. Based on the outcome of the unit root test, a maximum order of integration (d) of 1 was determined. Thus, the Toda-Yamamoto VAR(k+dmax) for the sub-periods was determined as 2. However, for the entire period of 1960-2019, the analysis of VAR(k+dmax) using 2 indicated the presence of serial correlation and instability in the model, necessitating the utilization of a lag length of 3 specified by the sequential modified LR test statistics. The Toda-Yamamoto VAR(k+dmax) for the entire period was 4. The results of the lag order selection criteria are reported in table 3, 4 and 5.

Table 3: VAR Lag Order Selection Criteria for the Entire Period 1960-2019

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-767.7998	NA	52327369	29.12452	29.27322	29.18170
1	-678.0927	162.4884	3249016.*	26.34312*	27.08663*	26.62904*
2	-669.5062	14.25683	4345515.	26.62287	27.96119	27.13752
3	-651.0748	27.82093*	4075296.	26.53113	28.46424	27.27451
4	-640.2892	14.65210	5231744.	26.72790	29.25582	27.70001
5	-628.3053	14.47119	6658748.	26.87944	30.00217	28.08029

Table 4: VAR Lag Order Selection Criteria for Sub-period 1960-1985

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-318.9026	NA	18387772	28.07849	28.27596	28.12815
1	-288.7061	47.26410*	5502421.*	26.84401*	27.83139*	27.09233*

Table 5: VAR Lag Order Selection Criteria for Sub-period 1986-2019

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-405.6865	NA	1550327.	25.60540	25.78862	25.66613
1	-351.5856	91.29511*	144772.5*	23.22410*	24.14019*	23.52776*
2	-339.2377	17.75011	191599.5	23.45236	25.10131	23.99894

Toda-Yamamoto Test

The Toda-Yamamoto test results for the entire and sub-periods are discussed in this section. The result for the entire period of 1960-2019, reported in table 6, shows one-way causality from economic growth to money supply, implying that economic growth granger causes financial development. This supports the demand-following hypothesis. The AR roots of the characteristic polynomial presented in table 7 and figure 1 shows that the model is stable as all roots lie within the polynomial bound and are less than one.

Table 6: Result for the Entire Period: 1960-2019

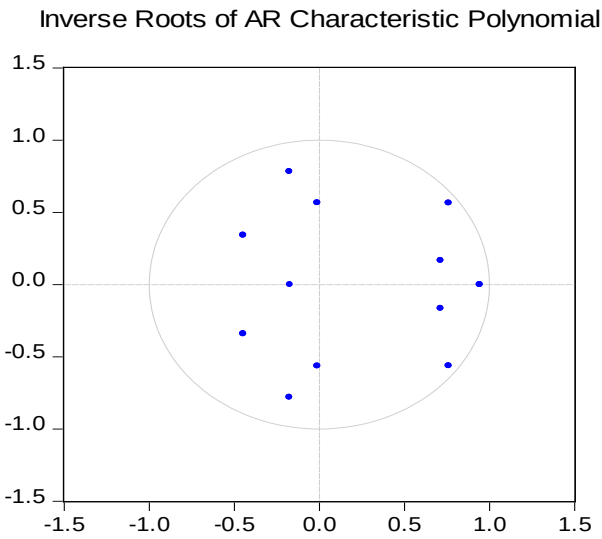
Null Hypothesis	Chi-sq	Df	Probability	Causality
MS does not granger cause RG	3.439991	3	0.3286	No causality
RG does not granger cause MS	10.93855	3	0.0121	Unidirectional causality
CP does not granger cause RG	4.895980	3	0.1796	No causality
RG does not granger cause CP	7.000176	3	0.0719	No causality
LR does not granger cause RG	3.384153	3	0.3361	No causality
RG does not granger cause LR	0.015993	3	0.9995	No causality

Table 7: Roots of Characteristic Polynomial

Root	Modulus
0.761435 - 0.564041i	0.947589
0.761435 + 0.564041i	0.947589
0.943287	0.943287
-0.175221 - 0.781932i	0.801324
-0.175221 + 0.781932i	0.801324
0.714105 - 0.166566i	0.733274
0.714105 + 0.166566i	0.733274
-0.010748 - 0.564634i	0.564736
-0.010748 + 0.564634i	0.564736
-0.446187 - 0.341610i	0.561944
-0.446187 + 0.341610i	0.561944
-0.171699	0.171699

No root lies outside the unit circle.
VAR satisfies the stability condition.

Figure 1: AR Roots Graph



The Granger causality result for the sub-period, 1960-1985 is provided in table 8, which shows no causality between the variables. Thus, suggesting the non-existence of supply-leading or demand-following hypothesis in the sub-period. The result of the stability test in table 9 and figure 2 indicate that the model is stable as all roots lie within the polynomial bound.

Table 8: Result for Sub-period 1960-1985

Null Hypothesis	Chi-sq	Df	Probability	Causality
MS does not granger cause RG	0.312392	2	0.8554	No causality
RG does not granger cause MS	3.327892	2	0.1894	No causality
CP does not granger cause RG	0.573694	2	0.7506	No causality
RG does not granger cause CP	1.751753	2	0.4165	No causality
LR does not granger cause RG	0.544479	2	0.7617	No causality
RG does not granger cause LR	0.391318	2	0.8223	No causality

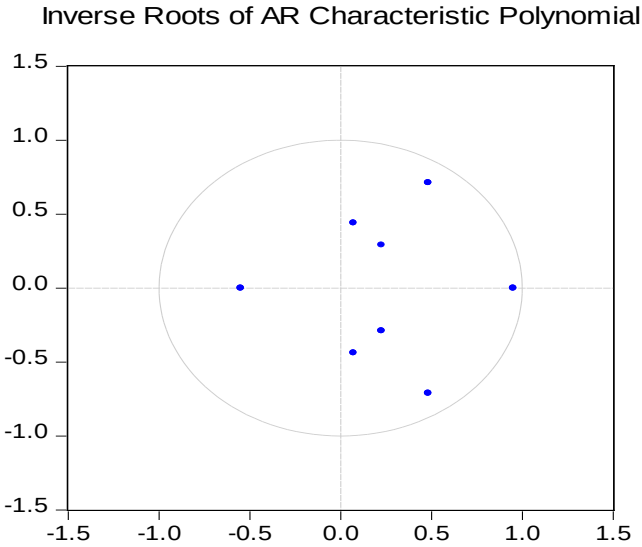
Table 9: AR Roots of Characteristic Polynomial

Root	Modulus
0.951114	0.951114
0.482517 - 0.710783i	0.859089
0.482517 + 0.710783i	0.859089
-0.549469	0.549469
0.072622 - 0.438656i	0.444627
0.072622 + 0.48656i	0.444627
0.225376 - 0.289920i	0.367217
0.225376 + 0.289920i	0.367217

No root lies outside the unit circle.

VAR satisfies the stability condition.

Figure 2: AR Roots Graph



The result of the Granger causality test for the sub-period, 1986-2019 presented in table 10 reveals no causality between the variables, indicating the non-existence of supply-leading or demand-following hypothesis in the period. The result of the stability test in table 11 and figure 3 show that the estimated model is stable as all roots lie within the polynomial bound.

Table 10: Result for sub-period 1986-2019

Null Hypothesis	Chi-sq	Df	Probability	Causality
MS does not granger cause RG	2.571953	3	0.4624	No causality
RG does not granger cause MS	2.222225	3	0.5276	No causality
CP does not granger cause RG	5.802149	3	0.1216	No causality
RG does not granger cause CP	3.410121	3	0.3326	No causality
LR does not granger cause RG	3.782533	3	0.2859	No causality
RG does not granger cause LR	2.110159	3	0.5499	No causality

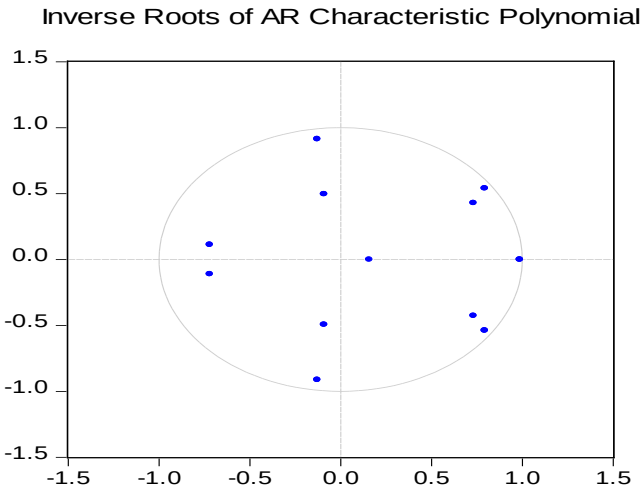
Table 11: Root of Characteristic Polynomial

Root	Modulus
0.987240	0.987240
0.794306 - 0.538069i	0.959395
0.794306 + 0.538069i	0.959395
-0.126666 - 0.913509i	0.922249
-0.126666 + 0.913509i	0.922249
0.733048 - 0.426961i	0.848325
0.733048 + 0.426961i	0.848325
-0.717885 - 0.111563i	0.726502
-0.717885 + 0.111563i	0.726502
-0.090509 - 0.495578i	0.503775
-0.090509 + 0.495578i	0.503775

0.158137	0.158137

No root lies outside the unit circle.
VAR satisfies the stability condition.

Figure 3: AR Root Graph



Overall, the results obtained from the study shows the existence of no causality for the sub-periods of 1960-1985 and 1986-2019. However, the result for the entire period, 1960-2019 evidenced causality running from economic growth to financial development, thus supporting the demand-following hypothesis. This is in line with Agu and Chukwu (2009) that also evidenced the demand-following hypothesis. However, it is in contrast with studies like Ogwumike & Salisu (2012) and Karimo & Ogbonna (2017), which supported the supply-leading hypothesis and others such as Osuji & Chigbu (2012) that indicated a bi-directional causality. Nevertheless, the result is in consonance with Agu and Chukwu (2009) that also support the demand-following hypothesis.

6. Conclusion and Recommendation

This study employed the Toda-Yamamoto approach to granger causality to test the hypothesis that financial development is supply-leading in the early stages and demand-following in the later stages of a country's economic development. It has attempted to fill the gap observed in respect of testing this hypothesis for Nigeria considering that similar tests have been carried out for other jurisdictions. The outcome of the study shows the non-existence of either the supply-leading or demand-following hypothesis for the sub-periods of 1960-1985 and 1986-2019. However, for the entire period of 1960-2019, the existence of demand-following hypothesis was established, suggesting that economic growth leads financial development in Nigeria. It is therefore recommended that government should intensify efforts towards fast-tracking development and diversifying the economy to ensure that the banking system impacts on the real economy through effective provision of credits. The study focused on the banking sector due to the limitation of data availability for other sectors of the financial system. Further research can be conducted taking into consideration the reforms that have occurred in the financial system over time.

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